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From the Editors

Some of Australia's iconic natural areas and species are under threat, from a variety of causes. Agreement has been given recently by the Queensland government to the dumping of dredging spoil from Abbott Point, within the Great Barrier Reef Marine Park; the Victorian high country is constantly in danger from the re-introduction of cattle grazing; and a program of shark culling has begun in Western Australia.

Threats to the natural world of this magnitude are not uncommon, but they occur also at a smaller scale, for example in local parks and nature reserves, and are equally regrettable. One thing that is needed at the local level is detailed field work, to provide a base level of knowledge of the diversity of the area.

It is pleasing then, to report here on a project of fauna monitoring in three urban parks in the Greater Melbourne area. Very few studies have been completed on species present in local parks so this program is both relevant and timely. Another noteworthy feature of this work is that it is collaborative, involving the FNCV's Fauna Survey Group, local environment groups and two Victorian Government departments—Parks Victoria and Melbourne Water.

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Front cover: Brush-tailed Phascogale *Phascogale tapoatafa* in nest box. Photo by Robin Drury. See page 15.
Back cover: Marilyn Hewish on receiving the Australian Natural History Medallion, 11 November 2013. Photo by Joan Broadberry. See page 30.

Survival and recolonisation following wildfire at Moyston West, Western Victoria. 2. Herpetofauna

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Abstract

Wildfire is a common occurrence in south-eastern Australia and affects fauna populations in various ways. In fragmented landscapes severe wildfire may lead to local extinction of some species; however, in other cases natural features such as cracks in the soil may provide refuges and the opportunity for some taxa to survive and recolonise surrounding areas. There is a lack of studies that provide both pre-wildfire and post-wildfire data on reptiles and amphibians especially at inland woodland sites. Data were collected to determine the presence and relative abundance of vertebrate fauna at a site near Moyston in Western Victoria on three occasions pre-wildfire and on seven occasions post-wildfire. Ten reptile and five amphibian species were recorded pre-wildfire, whilst 11 reptile and eight amphibian species were recorded post-wildfire. Bibron's Toadlet *Pseudophryne bibronii*, a species listed as threatened in Victoria, survived the wildfire in significant numbers in parts of the property severely burnt by wildfire. Several other species were recorded post-wildfire in sections of the property that were severely burnt. Numerous species appear to have survived the wildfire due to their ability to shelter underground, whilst others may have sheltered under large logs that were only partially burnt. Populations of other species may have survived due to a combination of breeding cycles, low metabolic rates and time of fire. At least one species of reptile may have recolonised the property from unburnt areas in neighbouring districts. (*The Victorian Naturalist* **131** (1) 2014, 4–14)

Keywords: wildfire, inland woodlands, refuges, reptiles, amphibians

Introduction

Numerous wildfires have burnt large parts of south-eastern Australia since European settlement over 200 years ago. The intensity of fire and condition of local environments produces a range of effects on reptiles and amphibians (Friend 1993). Several studies have been conducted into the status of reptile and amphibian populations following wildfire in Australia (Mather 1979; Lunney *et al.* 1991; Bamford 1992; Sass and Wilson 2006; Clemann 2009; Clemann and Antrobus 2010; Clemann *et al.* 2010; Howard *et al.* 2011; Howard *et al.* 2012). Penman and Towerton (2007) reported on the response of Verreaux's Tree Frog *Litoria verreauxii verreauxii* to a prescribed burn. Other studies have examined the effects on reptiles of experimental, low-intensity controlled fires (Trainor and Woinarski 1994; Masters 1996; Woinarski *et al.* 1999; Singh *et al.* 2002; Driscoll and Henderson 2008). Few studies, however, provide both pre-wildfire and post-wildfire data on reptiles or amphibians (Howard *et al.* 2010; Gillespie and West 2012). Without such information, land managers cannot know the true effects of fire and cannot make informed decisions on the management of wildlife populations. This paper aims to provide evidence from a woodland site in western Victoria on how reptiles and amphibians are able to survive wildfire. It follows other similar data from this location relating to the ability of mamals to survive wildfire (Homan 2012a).

Site Description

Wuurak is a 150 ha Land for Wildlife property situated 7 km west of Moyston (37° 18' S, 142° 41' E) and approximately 210 km west of Melbourne. A study to determine the presence and relative abundance of vertebrate fauna commenced at the property in October 2004 (Homan 2012a). Four Ecological Vegetation Classes (EVCs) are represented at Wuurak: Heathy Woodland, Sand Forest, Plains Grassy Woodland and Damp Sands Herb-rich Woodland (Fig. 1; DSE 2004; Homan 2012a). Gilgai is a soil formation where the land surface develops a pattern of depressions and mounds of various sizes. This condition arises as a result of alternate wetting and drying of clay soils and also produces deep cracks that can penetrate to well

Fig. 1. Map of Ecological Vegetation Classes at Wuurak Land for Wildlife property.

over 1 m (McKenzie *et al.* 2004). At Wuurak, gilgai was present in sections of Plains Grassy Woodland adjacent to Damp Sands Herb-rich Woodland along Reservoir Creek.

In December 2005 and January 2006, a severe wildfire (known as the Mt Lubra Fire) burnt 46% of the Grampians National Park and adjoining areas in western Victoria, especially around the Moyston district (Fig. 2). Wuurak was severely impacted by the wildfire; most of the property was severely burnt (all layers of vegetation including tree canopies and most fallen logs destroyed), whilst much smaller areas were either moderately burnt (tree canopies unburnt and many large logs only partially burnt) or lightly burnt (tree canopies unburnt with tree trunks lightly scorched and logs only lightly burnt). Two very small areas remained unburnt; an area of approximately 1 ha of Plains Grassy Woodland around farm buildings and a plant nursery; and an area of approximately 0.5 ha around a natural spring at the southern end of Reservoir Creek. The fire edge extended to approximately 30 km south, 20 km north, 25 km west and 5 km east of the property.

Methods

Several techniques were employed specifically to detect the presence of reptiles and amphibians (Homan 2012a; Table 1). These were funnel trapping, post-fire only (Ecosystematica Environmental Consultants, WA), artificial refuges, post-fire only (standard roof tiles, 410 x 245 mm), pitfall trapping, active searching (rock, log and debris turning; scanning possible reptile basking sites with binoculars) and aural amphibian survey (calling male frogs). One pitfall line consisting of ten 20 L plastic buckets was established on a sand-dune in Heathy Woodland. Buckets were 5 m apart and a 300 mm high aluminium flywire drift fence stretched for 60 m. Two lines of funnel traps were established in Damp Sands Herb-rich Woodland; the first was established 35 months post-fire and the second 82 months post-fire. Each line consisted of 20 funnel traps set 5 m apart in pairs, one on each

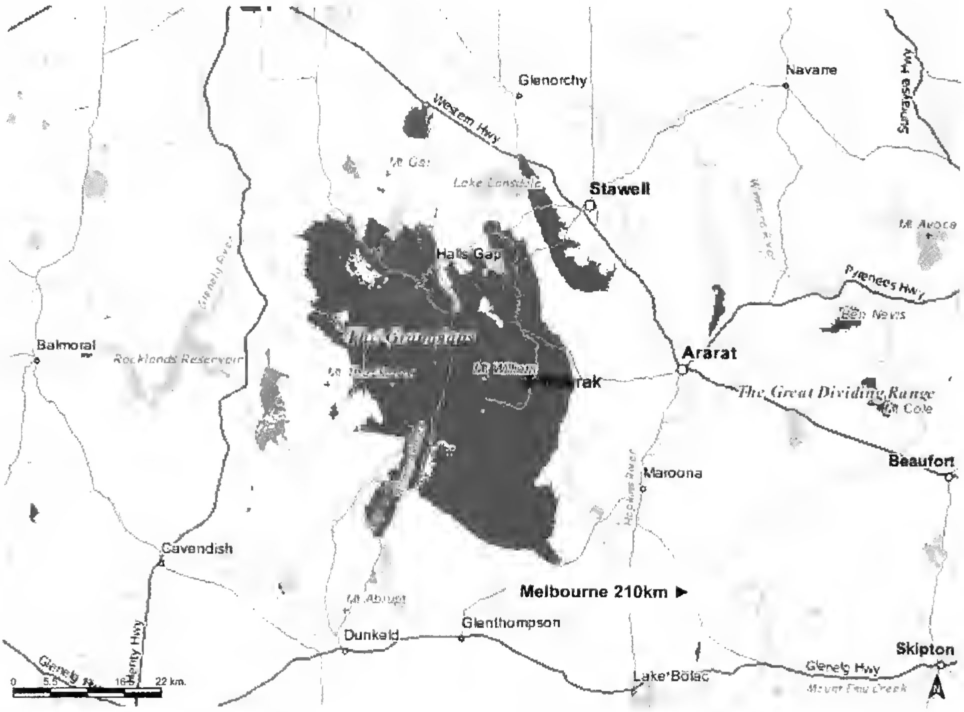

Fig. 2. Map showing extent of Mt Lubra wildfire December 2005/January 2006.

Table 1. Survey methods and effort completed pre-wildfire and post-wildfire for each Ecological Vegetation Class (EVC) at Wuurak in western Victoria. HW = Heathy Woodland; DSHRW = Damp Sands Herb-rich Woodland; PGW = Plains Grassy Woodland; SF = Sand Forest. Pitfall, Funnel, Cage and Elliott = trap-nights (Cage and Elliott daylight sampling only); ASH = active search hours; AAS. = aural amphibian survey, minutes; Roof Tiles = number laid.

		Survey Method						
EVC		**Pitfall**	**Funnel**	**Cage**	**Elliott**	**ASH**	**AAS**	**Roof Tiles**
HW	Pre-fire	60				2		
	Post-fire	110				2		
DSHRW	Pre-fire			200	60	5	60	
	Post-fire		120		90	12	120	
PGW	Pre-fire					2	60	
	Post-fire					6	120	25
SF	Pre-fire					2		
	Post-fire					2		20

side of a 300 mm high aluminium flywire drift fence that stretched for 60 m. Standard roof tiles were laid in two locations on the property; one month post-fire 20 tiles were laid in a line in pairs 1 m apart, with 5 m between each pair in an area of badly degraded Sand Forest that was severely burnt. A grid of 25 standard roof tiles was established 59 months post-fire in an area of Plains Grassy Woodland that was moderately burnt. The grid contained five lines with five tiles on each line. Lines and tiles were spaced at 5 m.

The study sites were surveyed on three occasions before wildfire (October 2004, November 2004 and March 2005) and on seven occasions after wildfire (December 2008, April 2010, December 2010, March 2011, April 2012, November 2012 and March 2013). Overall, 640 trap-nights were completed—320 pre-fire and 320 post-fire; active searching was conducted for 33 hours—11 pre-fire and 22 post-fire; aural amphibian survey was conducted for 360 minutes—120 pre-fire and 240 post-fire. Roof tiles in degraded Sand Forest were checked once during each visit post-fire; roof tiles in Plains Grassy Woodland were checked once during each visit after December 2010 (Table 1). Common and scientific names and taxonomy follow the Victorian Biodiversity Atlas, except for Bibron's Toadlet *Pseudophryne bibronii* which follows Tyler and Knight (2009).

Results

Pre-wildfire

One gecko, five skinks, two dragons and two elapid snakes were recorded pre-wildfire (Table 2). One hylid frog and four myobatrachid frogs were recorded pre-wildfire (Table 3). Amphibians included Bibron's Toadlet *Pseudophryne bibronii* (also known as Brown Toadlet) (Fig. 3), a species listed as threatened in Victoria (DSE 2013). One individual was captured in a pitfall trap in Heathy Woodland, and males were heard calling in significant numbers in Plains Grassy Woodland.

Post-wildfire

One gecko, six skinks, two dragons and two elapid snakes were recorded post-wildfire (Table 2). One hylid frog and seven myobatrachid frogs were recorded post-wildfire (Table 3). Bibron's Toadlet was recorded in several areas that were severely burnt. Individuals were captured in pitfall traps in Heathy Woodland, large numbers were heard calling in Plains Grassy Woodland and one individual was found under a roof tile in degraded Sand Forest.

Discussion

There is a lack of published information on the effects of fire on reptiles and amphibians, especially at inland woodland sites (Friend 2004). Available data, however, suggest that many reptiles and amphibians may be more resilient to the immediate effects of fire than mammals, due in part to their ability to construct burrows or shelter underground (Bamford 1992; Friend 1993). Many reptiles that inhabit dry places or areas with soft soils construct burrows (Heatwole and Taylor 1987; Cogger 2000). At sites with hard soils, many small reptiles will use deep cracks in the ground or burrows constructed by other taxa, such as spiders or

Table 2. Reptiles recorded in each Ecological Vegetation Class (EVC) at Wuurak, Western Victoria, before and after wildfire in January 2006. Key: EVC = Ecological Vegetation Class; DSHRW = Damp Sands Herb-rich Woodland; HW = Heathy Woodland; SF = Sand Forest; PGW = Plains Grassy Woodland; E = estimated number.

		Pre-wildfire			Post-wildfire						
Species	**EVC**	10/04	11/04	3/05	12/08	4/10	12/10	3/11	4/12	11/12	3/13
Months pre- and post-wildfire		-15	-14	-10	+35	+51	+59	+62	+75	+82	+86
Marbled Gecko *Christinus marmoratus*	PGW		1			1	1	1		1	2
Eastern Three-lined Skink *Acritoscincus duperreyi*	PGW		1				1				
	DSHRW			1	1						
Large Striped Skink *Ctenotus robustus*	HW										1
Garden Skink *Lampropholis guichenoti*	HW		3	1			1				2
	DSHRW				30E						
	PGW									1	
Bougainville's Skink *Lerista bougainvillii*	HW		6	1							
	SF					2		1		2	
Common Blue-tongued Lizard *Tiliqua scincoides*	DSHRW		1								
	SF								1		
Stumpy-tailed Lizard *Tiliqua rugosa*	DSHRW		3			1					
	HW						1				
Tree Dragon *Amphibolurus muricatus*	HW			3				2			2
	PGW					1					
	SF									1	
Bearded Dragon *Pogona barbata*	SF		1							1	1
Tiger Snake *Notechis scutatus*	DSHRW			1	1					1	
	PGW										1
Little Whip Snake *Parasuta flagellum*	SF					2		3	1	3	4
Eastern Brown Snake *Pseudonaja textilis*	HW		1								

Table 3. Amphibians recorded in each Ecological Vegetation Class (EVC) at Wuurak, Western Victoria, before and after wildfire in January 2006. DSHRW = Damp Sands Herb-rich Woodland; HW = Heathy Woodland; SF = Sand Forest; PGW = Plains Grassy Woodland. E = estimated number.

				Pre-wildfire		Post-wildfire					
Species	**EVC**	10/04	11/04	3/05	12/08	4/10	12/10	3/11	4/12	11/12	3/13
Months pre- and post-wildfire		-15	-14	-10	+35	+51	+59	+62	+75	+82	+86
Southern Brown Tree Frog *Litoria ewingii*	DSHRW		3E			5E	5E	2			
	PGW							3			1
Common Froglet *Crinia signifera*	DSHRW	2	5E		10E	30E	10E	5E	5E	8	
	PGW									1	1
Plains Froglet *Crinia parinsignifera*	DSHRW				5E		5E				
	PGW										1
Southern Bullfrog *Limnodynastes dumerilii*	DSHRW				5E						
	HW		1	2			16	6			7
	PGW									1	
	SF										1
Striped Marsh Frog *Limnodynastes peronii*	DSHRW						5E				
Spotted Marsh Frog *Limnodynastes tasmaniensis*	DSHRW				5E	5E					
Geocrinia sp.	DSHRW			1							
Southern Smooth Froglet *Geocrinia laevis*	DSHRW					3					
Bibron's Toadlet *Pseudophryne bibronii*	PGW			20E		30E		60E			
	HW			1		1	2	2			2
	SF							1			

yabbies, for shelter (Clemann 2000; Sass and Wilson 2006). Numerous myobatrachid frogs have adaptations that allow them to burrow in soil during times of inactivity, with some species remaining underground for long periods (Tyler 1989). Some of the reptiles and amphibians recorded at Wuurak share these aspects of life history.

Few studies provide data on the ability of amphibian populations to survive wildfire. Howard *et al.* (2011) conducted amphibian surveys at two sites north-east of Marysville in Victoria, one which was severely burnt by wildfire and one which was only moderately burnt. At both sites, good populations of Common Froglets were detected nine months post-wildfire. Gillespie and West (2012) assessed the status of Spotted Tree Frog *Litoria spenceri* populations in the Taponga River catchment in north-east Victoria following wildfire. Initial results of the study indicated that the wildfire did not appear to have an adverse impact on Spotted Tree Frogs.

At Wuurak more amphibian species and individuals were recorded post-fire, which is certainly due, partly, to increased effort, but also may be due to the breaking of the drought in

Fig. 3. Bibron's Toadlet *Pseudophryne bibronii*. Photo by Peter Homan.

2010. Amphibian activity is greatly influenced by rainfall and most records of calling male frogs and captures in pitfall traps and funnel traps were obtained during or around rain events. Other factors can affect amphibian surveys. Ten months pre-fire, one *Geocrinia* sp. was found on the ground by chance at night, but could not be identified to species level. Two species of this genus are known from Victoria: the Victorian Smooth Froglet *Geocrinia victoriana* has a wide distribution throughout southern and central Victoria, whilst the Southern Smooth Froglet *Geocrinia laevis* has a more restricted distribution, being found mostly in the south-west of the state (Hero *et al.* 1991). The ranges of the two species rarely overlap; however, both have been recorded in the eastern Grampians region (Gollmann 1991). Both species have similar body markings and can be readily identified only by their different advertisement calls. At no time pre- or post-fire were calls of Victorian Smooth Froglets heard at Wuurak. Fifty-one months post-fire the distinctive calls of male Southern Smooth Froglets were heard at night in an area of Damp Sands Herb-rich Woodland that was severely burnt. This visit to the property coincided with rainfall, during the restricted calling time for males of this species.

The survival of amphibians at Wuurak may be due to several factors including the presence of suitable refuges and soil type and structure. It is probable that the population of Bibron's Toadlets in the Plains Grassy Woodland section of the property survived the wildfire by sheltering in deep cracks that were present in gilgai depressions. Along Reservoir Creek and in the Heathy Woodland/Sand Forest sections of the property the deep sandy soils provided ideal places for Bibron's Toadlet and other burrowing species, such as Southern Bullfrog, to seek refuge. There is a lack of studies investigating Bibron's Toadlet populations following wildfire. Howard *et al.* (2010) assessed the status of Bibron's Toadlet and Southern Toadlet *Pseudophryne semimarmorata* 12 months post-wildfire at over 100 sites in the Kinglake area and surrounding districts. Bibron's Toadlet was detected in very small numbers and only from relatively undisturbed habitats in unburnt areas; however, historical data indicated a decline

Fig. 4. Large River Red Gum log that survived wildfire near Reservoir Creek. Photo by Peter Homan.

in the population of the species throughout the study area for many years pre-wildfire.

Other amphibian species may have survived wildfire at Wuurak by using cracks in the ground or by sheltering under large River Red Gum *Eucalyptus camaldulensis* logs (Fig. 4) that survived in Plains Grassy Woodland adjacent to Reservoir Creek, and then recolonising nearby areas. The Southern Brown Tree Frog, Common Froglet, Plains Froglet, Southern Smooth Froglet, Spotted Marsh Frog and Striped Marsh Frog often shelter under logs during times of inactivity (Homan pers. obs.).

The survival of reptiles at Wuurak may be due to several factors including breeding cycles combined with time of fire, low metabolism, attenuated body shape, burrowing habits and the ability to shelter under and inside large logs. The Garden Skink, an egg layer, breeds in spring, with births taking place in late summer (Joss and Minard 1985). Eggs are laid, often communally under rocks, logs or other hard terrestrial structure (Homan pers. obs.). The eggs of Garden Skinks would have been deposited under various logs throughout the property at the time of the fire. Some adult Garden Skinks may have sheltered under large logs or used cracks in the ground to escape the fire. The small size and attenuated body shape are conducive to the species using such refugia. Some individuals may have used yabby holes along Reservoir Creek or sheltered underground in the damp sands in this part of the property. Significant numbers of Garden Skinks were detected 35 months post-fire amongst dense thickets of regenerating Swamp Gum *Eucalyptus ovata* in Damp Sands Herb-rich Woodland along Reservoir Creek. One individual was captured in an Elliott trap that was left open for daylight sampling. Interestingly, no Garden Skinks were recorded in this EVC pre-fire or again at any other time post-fire, despite considerable time spent in this part of the property conducting a range of vertebrate survey techniques. In the Heathy Woodland/Sand Forest section (Fig. 5) Garden Skinks may have survived by sheltering in the deep sandy soil. Lunney *et al.* (1991) found Garden Skinks present in all habitats during studies up to 48 months following intense fire, with greater numbers in gullies than

Fig. 5. Regenerating Heathy Woodland. Photo by Adam Merrick.

on ridges. Penn *et al.* (2003) found a significant increase in Garden Skink numbers 20 months after a low-intensity, hazard reduction fire. Lunney *et al.* (1991) suggested that survival of Garden Skink can be attributed to its ability to take refuge underground.

Bougainville's Skink (Fig. 6), a fossorial species with an attenuated body shape (Cogger 2000), most probably would have sheltered in the sandy soil in Heathy Woodland and Sand Forest, thus surviving wildfire in these parts of the property. The Eastern Three-lined Skink, Stumpy-tailed Lizard, Common Blue-tongued Lizard and Tiger Snake may have recolonised other parts of the property after sheltering under or inside large River Red Gum logs that were only partially burnt in Plains Grassy Woodland.

Female Tree Dragons construct a burrow in which eggs are laid in late spring, with young hatching and leaving burrows in late summer (Harlow and Taylor 2000). Tree Dragon eggs would have been deposited underground in nesting burrows when the fire swept through the property in early January. Despite this, there is no doubt that mortality amongst adult Tree Dragons may have been high due to the severity of the fire and the partially arboreal habits of the species. A very small population survived in the unburnt area around farm buildings mentioned above. In areas where fire intensity is low, arboreal dragons have survived wildfire by climbing into the unburnt canopies of large trees (Griffiths and Christian 1996); however, in the Heathy Woodland/Sand Forest areas of Wuurak, the canopies of virtually all eucalypts were burnt. Minimal data exist on the effects of wildfire on Tree Dragon populations. Clemann *et al.* (2010) conducted surveys of threatened herpetofauna north of Dargo in Victoria 12 months post-wildfire. During this study, Tree Dragons were seen basking on fallen timber beside tracks in areas that were burnt by wildfire. Whilst the Tree Dragon was recorded at Wuurak relatively quickly post-fire, the Bearded Dragon was not recorded until 82 months post-fire. Before the fire, this species was often seen by the landowners. Bearded Dragons may not have survived wildfire at Wuurak and most likely recolonised the property from the east where unburnt habitat was 5 km away.

Fig. 6. Bougainville's Skink *Lerista bougainvillii*. Photo by Peter Homan.

The only records of Little Whip Snakes were obtained from under roof tiles post-fire from an area of severely degraded Sand Forest. This small, nocturnal elapid snake readily uses artificial refuges (Homan 2012b). The location where Little Whip Snake was recorded was severely burnt and was adjacent to a large area of Plains Grassy Woodland with cracking clay soils. When tiles were checked, several individuals escaped down holes and cracks that were present in the sandy loam soil. Little Whip Snakes almost certainly survived wildfire by sheltering in soil cracks and other ground refuges that were readily available in this part of the property.

Overall, results of herpetofauna surveys at Wuurak provide further evidence that, due to a number of life history, reproduction and environmental factors, many species of reptiles and amphibians are able to survive wildfire. These factors include the ability to shelter underground or to use other refugia and breeding cycles that include the construction of nesting burrows.

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The use of remote cameras at the nestboxes of arboreal mammals, Brush-tailed Phascogale *Phascogale tapoatafa* and Sugar Glider *Petaurus breviceps* in the Rushworth State Forest

Fauna Survey Group Contribution No. 26

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Abstract

The Fauna Survey Group of the Field Naturalists Club of Victoria has a program for monitoring nestboxes in the box-ironbark forests near Rushworth, Victoria. In addition to its normal monitoring program, in May 2012 five remote cameras were set up for 23 nights with a view to monitoring the Sugar Glider and Phascogale activity at selected sites. The cameras produced images of nestbox inhabitant activity, as well as that of some visitor animals. At face value the results of this simple survey provide support for previous research into the behaviour and activity of the target species around nesting sites. The images showed that both species are active only between dusk and dawn, they both have periods of inactivity and both use multiple nesting sites; however, there were also gaps in 'evidence', which demonstrate that some camera settings and site set-up processes need to be adjusted to increase the confidence in any findings. (*The Victorian Naturalist* 131 (1) 2014, 15-23).

Keywords

Introduction

Box-ironbark vegetation in Victoria once covered approximately 965 000 ha, but by 1993 had been reduced to around 275 000 ha (Environment Conservation Council 1997). This change has taken place largely due to a combination of agriculture, mining and forestry. In addition to the reduction of total tree cover, there has been a significant change in the forest structure. One change has been the reduction in hollow-bearing trees (Traill 1991), which provide habitat for a range of biota, including arboreal mammals.

Artificial nestboxes have proven to be successful in providing habitat for arboreal mammals and contribute to their management and conservation (Beyer and Goldingay 2006).

Ninety-two nestboxes were constructed and placed in the forests near Rushworth in 1992 by the Australian Trust for Conservation Volunteers (Soderquist *et al.* 1996). Since then the nestboxes have been monitored, maintained and supplemented by the Fauna Survey Group (FSG) of the Field Naturalists Club of Victoria (FNCV). There are now 145 nestboxes.

The nestbox-program takes the form of a physical count of nestbox inhabitants and the type of nest.

Sugar Glider *Petaurus breviceps* and Brush-tailed Phascogale *Phascogale tapoatafa* (hereafter Phascogale), are the main users of these boxes, but other species such as the Squirrel Glider *Petaurus norfolcensis*, Yellow-footed Antechinus *Antechinus flavipes*, Common Brushtail Possum *Trichosurus vulpecula* and Common Ringtail Possum *Pseudocheirus peregrinus* have been recorded also (Myers and Dashper 1999). In Victoria, the Squirrel Glider is considered to be endangered, while the Phascogale is considered vulnerable (DSE 2013).

Phascogales are small, carnivorous, arboreal marsupials occupying dry forests (Cuttle 1982). The species exhibits an annual post-mating male mortality (Cuttle 1982). With rare exceptions they are nocturnal (Scarff *et al.* 1998). Both sexes are solitary in nature (Soderquist and Ealey 1994). Sugar Gliders are also nocturnal and arboreal, but unlike phascogales, live in nesting communities (Smith 1973). They are omnivorous, feeding predominantly on plant exudates in autumn and winter and insects in spring and summer (Smith 1982).

A number of studies have examined the activity of these species around the nesting or roosting sites.

This study uses remote cameras to investigate their success in monitoring activity of Phascogales and Sugar Gliders.

The positioning of an external camera has its limitations, but could be expected to reveal or confirm behaviours such as the hours of occupation, the number of occupants and any predator activity. Any issues with the cameras, or their deployment, should also be revealed. How cameras might be used to further the knowledge of the nestbox inhabitants is also considered.

Methods

On the weekend of 12 and 13 May 2012, the FSG carried out its annual survey of the nestboxes. Each box was inspected and the species inhabiting them recorded. The inspectors were asked to identify those occupied boxes where adjacent trees would allow for remote camera monitoring. Five boxes were selected from these descriptions. At the time of inspection, two of these selected nestboxes contained multiple numbers of sugar gliders (cameras 4PB and 5PB) and three contained single phascogales (cameras 1PT, 2PT and 3PT). Four of the cameras were set up on the same day as the box inspection; one was installed on the day after.

Camera site selection was based on the best tree available. The cameras were fixed to the nearest convenient tree, adjacent to the nestbox and at approximately the same height. They were fixed by way of an External CCD Camera Housing Mounting Bracket, supplemented with a wooden frame and ant-cap for protection and support (Fig. 1). The entry hole was visible in all nestboxes except one (4PB).

The cameras were between 1.3 and 4.1 m from the nestbox. Camera 1PT was 2.3 m away, 2PT (2.8 m), 3PT (3.0 m), 4PB (1.3 m) and 5PB (4.1 m).

Four of the cameras were Ltl Acorn 6210 MC and the other a Faunatech Scoutguard DTC-530. The Ltl Acorn cameras (each having an 8 GB memory card), have the functionality to take still and video images at the one trigger event and were set for three still shots (stills) and a 60 second video. The Scoutguard (with a 2 GB card and the functionality to take either still or video shots) was set for a 60 second video. There was a three minute interval between trigger events. All cameras were set for 24 hour action and normal sensitivity. They were also set with the time stamp on, which meant that date and time were recorded on all images. Temperature was recorded on the Ltl Acorn stills.

Fig. 1. Camera set-up.

According to the product manuals, the trigger time for the Ltl Acorn cameras is 1.2 seconds with 1.0 second between shots (with the date stamp on) and the Scoutguard trigger time is 1.3 seconds. This meant that because the Ltl Acorn took three stills first, the video triggered after approximately 4.2 seconds.

All cameras were set to take the best quality images available. For the Ltl Acorn the stills were set for 12 megapixel shots and for 1440 x 1080 video, with the Scoutguard set for 640 x 480 video. All cameras had been operated in the field previously and had produced images.

All the cameras were passive infrared (PIR) cameras. These cameras trigger in response to changing temperature, generally associated with movement. The cameras take colour images during the day and black and white at night. All the images were analysed twice to identify their contents, with those containing a phascogale or sugar glider then being analysed in more detail.

The duration of the trigger event was calculated from the time an animal first appeared to

the time it disappeared from view. The duration included the initial camera response time and the time between shots. An appearance of an animal after the first animal disappeared was not included in this assessment.

The nestboxes were checked when the camera was retrieved and only site 1PT was vacant.

Results

In total there were 278 trigger events producing a total of 1122 images including videos. There were 131 events showing animal images (animal triggers). This leaves 147 trigger events where the images did not show an animal. These have been recorded as non-animal triggers, although it is possible that they were triggered by an animal which was not recorded.

The species recorded were largely nestbox occupants. Other species recorded were Eastern Grey Kangaroo *Macropus giganteus* (4 trigger events), Laughing Kookaburra *Dacelo novaeguinea* (1), Flame Robin *Petroica phoenieca* and a treecreeper in the same trigger event (1) and a sugar glider near a phascogale nestbox (1).

The still images on the Ltl Acorn ranged from 0.5 to 1.2 Mb in size and the videos from 43 to 52 Mb. The Scoutguard videos were approximately 70 Mb. The memory cards for 2PT and 4PB were full.

Three of the cameras produced images of animals, two at the Sugar Glider boxes and at one of the Phascogale boxes. The other two cameras produced no animal pictures. The results for each camera are summarised below (Table 1).

General observations were that most entry and departure was from the top of the box and animals had no difficulty grasping the 19 mm box lid and manoeuvring their way in and out of the entrance. As an example of speed of movement, one video replay shows that one Sugar Glider covered around 4 m in less than one second.

Camera 1PT produced one trigger event, which occurred as it was being taken down from the tree during collection. In an unrelated test, camera 1PT was shown not to trigger in the dark.

Camera 2PT (Fig. 2) shows four phascogale trigger events, on days three, seven and 12. The sequence was leaving the box, then entering, then leaving then entering. One event showed the phascogle bringing nesting material to the box. The first image always showed the animal out of the box, there being no image of the phascogale actually leaving the nestbox hole.

Table 1. A summary of the output from each camera, showing number of the day on which it was last triggered (maximum possible = 24), the total trigger events and the number of those showing animals (animal trigger events).

Camera number	Last working day	Total number of trigger events	Number of animal triggers events
1PT	23	1	0
2PT	12	108	5
3PT	11	5	0
4PB	19	141	104
5PB	23	29	22

The other animal trigger event was that of a Sugar Glider, on the tree, but not approaching the nest.

Camera 3PT produced 5 trigger events on day 1 at start up (1), day 2 (1) and day 11(3). There were no animal images.

Camera 4PB (Fig. 3) shows regular departure and entry activity on the 19 days of operation. As best as could be seen (this camera did not cover the nestbox hole), the animals entered the box around dawn and did not leave until early the following evening. There were more trigger events around the re-entry time than at the time the animals left the nestbox.

Every second or third night (days 2–3, 4–5, 6–7, 9–10, 12–13 and 16–17) there were no animal trigger events for around 20 hours (between around 0600 hours to 0200 hours the next day); however, there were non-animal trigger events (mostly single events) during this period and most took place around 1800 hours.

Camera 5PB (Fig. 4) shows Sugar Glider trigger events on most evenings, with three one-day gaps and one three-day gap. All these events were in the evening and only one showed a Sugar Glider entering the nestbox. In no cases did the first image of a trigger event show the Sugar Glider exiting the nestbox; it was always on the tree.

Total trigger events (n=278) occurred throughout the day, but animal triggers (n=131) occurred mainly between dawn and dusk. All

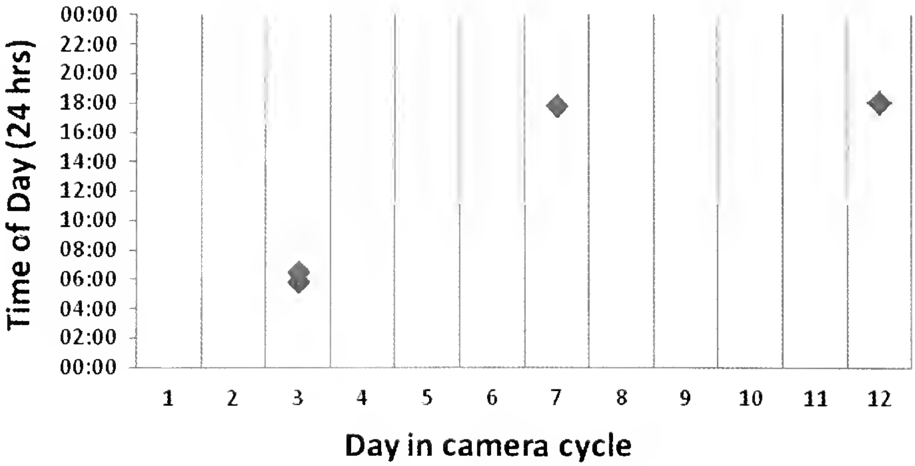

Fig. 2. The times of Phascogale trigger events from camera 2PT.

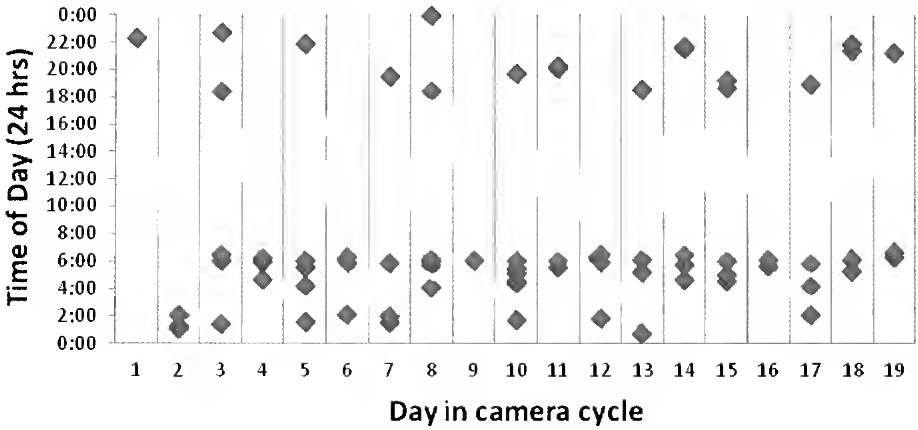

Fig. 3. The times of Sugar Glider trigger events from camera 4PB.

Sugar Glider and Phascogale triggers (n=125) occurred during this time. Non-animal triggers (n=147) occurred mainly in daylight hours. Many non-animal trigger events appeared to be caused by the movement of the tree on which the camera was attached. Fig. 5 contains a summary of the timing of events.

The maximum exposure time for any one event, given the three minute interval between shots, was around 63 seconds (three stills plus the 60-second video). There was no way of establishing the time an animal stayed around the nestbox if it was still there after the completion of the video. The three minute interval between triggers, combined with multiple animals in some nestboxes, made it impossible to be sure that consecutive trigger events showed the same animal. As seen in Fig. 6, below, the majority of trigger events (63%) were of less than 20 seconds' duration. Some 23% took less than 3 seconds.

Discussion

This project has given us the opportunity to review the use of the cameras, particularly in

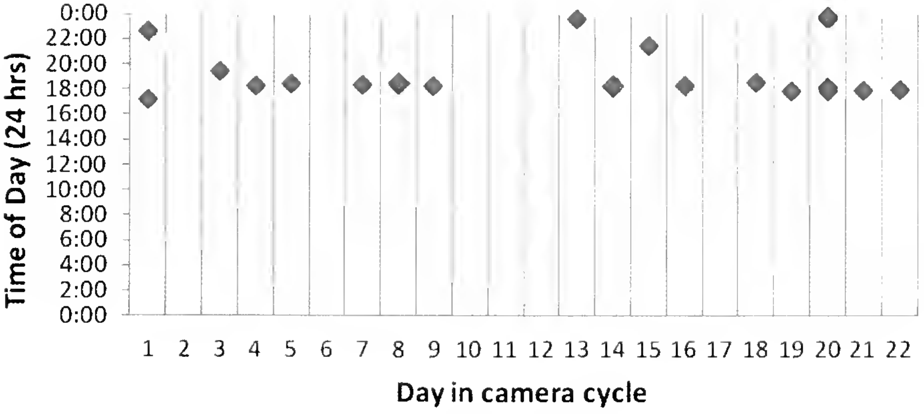

Fig. 4. The times of Sugar Glider trigger events from camera 5PB.

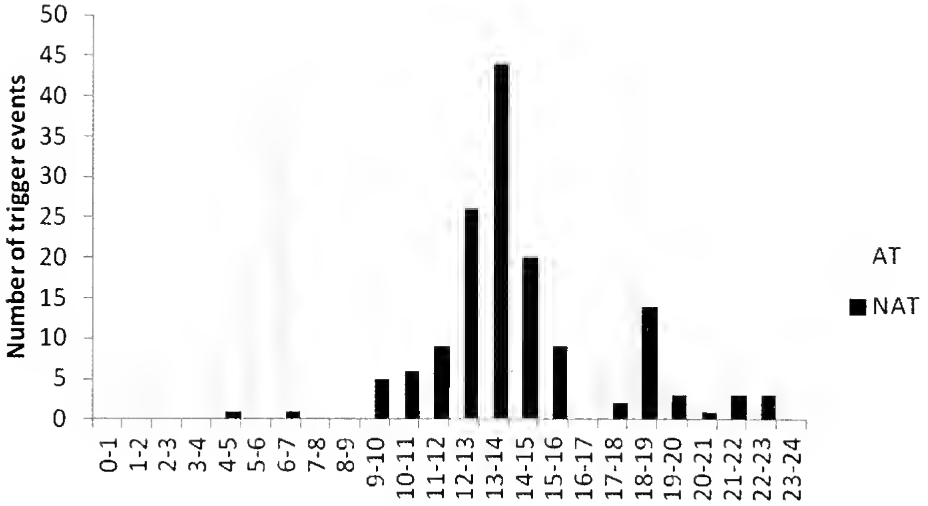

Fig. 5. A comparison of the time of day between animal (AT) and non-animal trigger events (NAT).

regards to monitoring nestboxes. The results showed that data about nestbox usage could be successfully obtained by using relatively inexpensive remote cameras. Passive infrared cameras have been shown to be effective in recording movement events (Dixon *et al.* 2009).

The findings cover issues of animal behaviour and camera performance, settings and siting.

Animal behaviour

Unfortunately, only one of the three cameras set to monitor Phascogale activity produced animal images. Even though there were only four phascogale events, the 12 days that the camera was in operation appeared to be characterised by extended stays in the box. According to the images, it was two days before the animal left

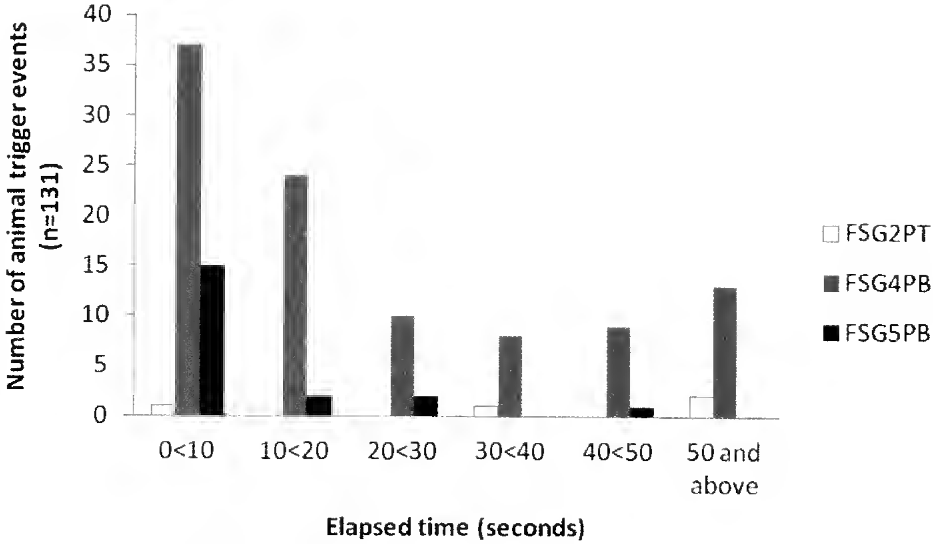

Fig. 6. Length of time of animal activity in trigger events containing Sugar Glider and Brush-tailed Phascogale nestbox occupants.

the box, and then only for around 40 minutes. This was followed by another four days in the box. (Periods of inactivity have been noted previously [Scarff *et al.* 1998], but for much shorter periods.) It was then another four days before the animal returned. The use of other roosting sites is not unusual and elsewhere Phascogales have been shown to use 19 nest trees (van der Ree *et al.* 2001) with their home range covering up to 150 ha (Soderquist 1995).

This nomadic lifestyle of the Phascogale makes it impossible to obtain any regular images from one camera. In addition to where an animal will be from one night to the next, it is very difficult to confirm the identity of the camera subject (Kays and Slauson 2008) without other techniques such as marking or radio tracking; however, during family rearing time, the female creates a nursery site which is occupied from when the lips of the young separate (about 48 days), until the family disperses (Soderquist 1993b). In a study of three Phascogale populations (Soderquist 1993a), births took place between mid-June and early August. Weaning takes place at about 100 days and the mothers leave the nest at around 140–150 days. Camera monitoring of nursery sites proves useful in studying the behaviour of the female and later the young. Some effort would be needed to identify such a site.

The cameras at the two Sugar Glider sites produced a more sustained sequence of images. Although these animals also change nest sites, their home range is much smaller (0.5 and 0.7 ha) than that of a Phascogale (Suckling 1984). Given that Körtner and Geiser (2000) found that movements tended to be infrequent, the species appears to be a better candidate for nest site monitoring by camera. Our results showed that both sites were in use for the extent of the camera operation.

The results at camera 4PB support previous findings of periods of inactivity (Körtner and Geiser 2000). Their study associated reduced foraging with cold or rainy nights. Bouts of torpor of between two and 23 hours were also associated with cold and rainy nights. The results from 4PB suggest that reduced activity occurred on six of the 19 nights. Some caution is necessary here. Although this camera showed most of the nestbox, it did not show the entrance hole or any of the tree from below. While the results on all cameras showed animals to approach the nest from above, it is possible that

their activity would not be registered if the occupants of camera 4PB approached from below. It is also possible that the non-animal triggers occurring around 18:00 hours were caused by activity from this nest box, but no animal image registered.

None of the images of other species around the nestboxes revealed anything relevant to the occupants of the nestbox. Laughing Kookaburras have been known to prey on young Sugar Gliders (Suckling 1984). It could be argued that the time of 5 pm was relevant in that it is close to the time when Sugar Gliders leave the nestbox, but there was no behaviour to suggest that the nestbox was being used for anything other than a perch. The bird was not there after the 3-minute camera delay interval.

Sugar Gliders have been known to use nestboxes previously occupied by Phascogales (Myers 1997), but the single image in this study gave no clue to any change in tenancy. Other species detected were incidental to the nestbox occupants.

Camera issues

The 'experiment' revealed that a number of camera-related issues need to be addressed to improve the quality of outcomes in any further studies. It is possible that some of the results were compromised because of these issues. It is also possible that these cameras, at the less expensive end of the market, are not designed to cope with some of the demands of this project. The issues relate to the management of disk space, some of the camera settings and the setup processes.

Two of the cameras ceased to work because of a lack of available disk space. The chances of this happening can be reduced by increasing the size of the memory card as the cameras can take memory cards of up to 32GB. However, this could also mean an increase in unproductive analysis time, given the ratio of animal to non-animal triggers. The amount of disk space used can also be reduced by making a change to the camera settings, which are discussed below.

Trigger interval

The trigger interval was set for three minutes, largely to reduce the non-animal triggers caused by non-biotic temperature change and to conserve disk space. This proved ineffective and counterproductive, as two of the cameras reached their capacity anyway and there is a good chance that some activity was not captured as a result of the gap. Given that much of the activity around the box lasted less than 20 seconds, it is almost certain that animals leaving in the 3-minute gap following the first wave of departures were missed. It is therefore suggested that the cameras be set for the minimum interval available. This will eliminate, to the best of the camera's ability, any missed activity.

Image type and duration

Still images gave little indication of the animals' movement or behaviour and actually added three seconds to the start of the video which, with its extra shots per second, provided more useful data. As the majority of events were over in less than 20 seconds there is no need for a 60 second video. Overall, shorter videos with no stills would be more informative.

Timer

The cameras were set for 24-hour action. All the activity involving the nestbox occupants occurred between dusk and dawn. The timer setting on the cameras can be activated to monitor only this time period. This change eliminates the majority of the non-animal trigger events, reducing disk capacity issues.

Image quality

Another option to reduce the use of disk space is to select a lower video resolution setting (pixels per frame). Although this reduces the quality of the videos, it also reduces the amount of disk space required (Ltl Acorn undated). In this case, animal identification is not a key issue and therefore resolution may be sacrificed.

Sensitivity

The camera instructions suggest using low or normal sensitivity for external use, largely to reduce the effect of extraneous movement. A high setting is also recommended for high temperatures in order to distinguish a warm body from the ambient temperature. Given night-time use, where it would appear non-animal images are at their lowest, it might also be prudent to maximise the sensitivity setting to optimise the chances of recording an image.

Non-use of the time stamp
Both camera types have the facility to have the date and time-stamp on or off. The trigger speed can be increased by 0.5 seconds if this facility is not used (Ltl Acorn, undated). Although the reviewer of the images can he inconvenienced by not having this information on the image itself, it is still available on the memory of the camera disk. The extra speed appears valuable in these circumstances.

The results also showed that a number of the set-up techniques could be improved.

Siting
The speed at which the animals appeared to leave the box suggests that it is important to have the camera in a position where it has the earliest possible exposure to any movement. Detection would be enhanced if the camera was facing the nesthox hole because the animal is likely to trigger the camera as soon as it puts some part of its body in the camera's view.

Distance from camera to nestbox
Camera 4PB was sited 1.3 m from the nestbox and this produced two issues. Flaring (a bright patch that reduces picture quality) in images on this camera suggests a need to increase the distance to improve subject clarity. Flaring can also be reduced by placing packing tape over the camera flash (M Weston pers. comm.). The translucent nature of this tape still allows satisfactory pictures to be taken.

At 1.3 m not all the box was contained in the image. Increasing the distance would overcome this problem, as well as capturing more of the immediate area. This broader view is recommended to allow for the speed of movement of both species, but in particular the Sugar Glider.

Camera 5PB results show a pattern of gliders leaving the nestbox, but not returning. Even though the camera had only a side-on view of the nestbox there was no apparent issue with trigger events when the animals left the nestbox. Given this, and Sugar Gliders' propensity to enter and leave from the top, there is no reason to suspect that they could enter without being in view of the camera. There may be some reason that the Sugar Glider did not trigger the camera on the return journey. A combination of cold fur, small body and the 4.1 m camera distance (this set-up had the greatest distance between camera and nestbox), may mean there was insufficient temperature difference between the animal and the ambient temperature to register. A reduction in the camera to nestbox distance and the setting of the sensitivity to high (as mentioned above) may improve results.

The results suggest that a distance of 2–3 m would produce improved outcomes.

Time of set-up
In the case of camera 3PT (which had an excellent view of the nest box), the set-up was completed the day after the phascogale presence was recorded. The box was not re-checked on the day the camera was erected. Given the previous discussion on phascogale movement, it is essential that the box is checked at the time of camera installation, otherwise it is likely that the phascogale will have moved on and no images will be recorded; however, in this case there was an animal in the box at the time the camera was retrieved, so there was an opportunity for at least one animal trigger event. Why the camera did not respond to the animal's return is unknown. The camera has been working in other situations.

Quality assurance of cameras
The problem with camera 1PT was serendipitously discovered when multiple cameras were set up to record the same area. Although the camera had previously taken animal images, it had just been assumed that on its previous deployments no animals had passed through the detection zone during the night. Setting up at least two cameras together for testing, in preparation for deployment, would identify any such issues.

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Sugar Gliders photographed in nest box.

Sugar Gliders photographed by remote camera.

Observations of Spencer's Skink *Pseudemoia spenceri* from within the high canopy of an overmature Mountain Ash *Eucalyptus regnans*

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Abstract

During March 2012, whilst undertaking an aerial survey of an overmature Mountain Ash *Eucalyptus regnans* in Toolangi State Forest, a Spencer's Skink *Pseudemoia spenceri* was observed in the canopy at a height of ~50 m above ground level. In the following year, whilst surveying another overmature *E. regnans*, a pair of *P. spenceri* was detected at similar height within the canopy. These sightings demonstrate that thermoregulation in *P. spenceri* is not restricted to dead trees and that high canopies of overmature trees may be an important component of its habitat. Due to the difficulty of accessing the forest canopy it is likely that our understanding of arboreal habitat use has been underestimated for small vertebrates such as skinks. Our serendipitous sightings emphasise the need for further research in this area. (*The Victorian Naturalist* **131** (1) 2014, 24-27)

Keywords: Spencer's Skink *Pseudemoia spenceri*, Mountain Ash *Eucalyptus regnans*, arboreal, canopy

Introduction

Spencer's Skink *Pseudemoia spenceri* is an insectivorous species found in wet sclerophyll forest (Rawlinson 1974) and montane dry woodland (Clemann 2002). With well developed five-toed (pentadactyl) limbs, dorsoventral flattening and high agility, *P. spenceri* is the most arboreally adapted of south-eastern Australian scincids (Brown 1986). The use of aerial tree microhabitats provides opportunities for basking (Webb 1985; Brown and Nelson 1993), foraging (Brown 1986), shelter (Rawlinson 1974; Gibbons and Lindenmayer 2002) and predator avoidance. Previous records of the vertical extent of live tree use by *P. spenceri* are 10 m (Pengilley 1972 cited in Webb 1985), 22 m (Brown and Nelson 1993) and 15 m (Homan 2011) above ground level. Rawlinson (1974) documented the use of aerial microhabitats 50-75 m above ground level but believed *P. spenceri* to be restricted to dead trees and primarily associated with post-fire stands in wet sclerophyll forest. The validity of Rawlinson's report was questioned (Webb 1985) and as additional observations of *P. spenceri* at this height have not been documented it remained unclear to what extent this and other species may use the forest canopy in temperate south-eastern Australia.

Observations of Spencer's Skink

In March 2012, as part of an ongoing project to document Victoria's largest trees (Mifsud 2003), a Mountain Ash *Eucalyptus regnans* 73 m in height and 245.5 m³ trunk volume (Mifsud 2012 unpubl. data) was climbed with the use of arboricultural methods (Dial and Carl 1994) in Toolangi state forest (37° 33' 59S 11" S, 145° 27' 47.43" E). The tree was overmature with a broken top, which is characteristic of this growth stage (Ashton 1975). Using records of stand replacing fires in the area as a dating method (Ashton 2000), the tree was estimated to be ~400 years of age. The tree was located within an area of wet sclerophyll forest characterised by an overstorey of *E. regnans*, a midstorey tree layer of Blackwood *Acacia melanoxylon*, Silver Wattle *Acacia dealbata*, Myrtle Beech *Nothofagus cunninghamii* and a tall shrub layer of Soft Tree-fern *Dicksonia antarctica*, Rough Tree-fern *Cyathea australis* and Musk Daisy-bush *Olearia argophylla* (Costermans 1983). During this survey, a skink was observed within the canopy at a height of ~50 m above ground level. This individual did not exhibit an evasive response and actively climbed onto the legs and body of the surveyor (Fig. 1). On 23 March 2013, during the survey of another overmature *E. regnans*,

Fig. 1. Spencer's Skink on the leg-strap of a surveyor's harness. Photo by Mike Hanuschik.

65 m in height and 170 m^3 trunk volume (Mifsud 2013 *unpubl. data*) and also in Toolangi State Forest, a pair of *P. spenceri* was observed at a height of 50 m above ground level. One individual was basking in a sunspot on the trunk (height 55 m) and the other was stationary on a dead limb below the first. Neither individual exhibited an evasive response or changed positions as we ascended adjacent to their locations. The individual that had been basking proceeded to climb onto the body of a surveyor, remaining mainly stationary with periodic shuttling between the surveyor's arm, shoulder and back for a period of 15 minutes before being coaxed to return to the tree trunk (Fig. 2 and 3). With the exception of the aforementioned encouragement to leave the surveyor's body there was no handling or intentional interaction with the animals. A dark brown-olive colouration with golden-cream dorsolateral stripes, which are diagnostic characteristics of *P. spenceri* (Cogger 2000; Wilson and Swan 2010) were present in the observed animals.

Discussion

Pseudemoia spenceri forages on the forest floor and in aerial tree habitats with detritivorous insects such as saprophagous flies (Diptera), cockroaches (Blattodea) and termites (Isoptera) forming a significant component (40.7% within sample, n=82) of its diet (Brown 1986). Observations of ground based habitat use (≤1.2 m above ground level) recorded logs as the most commonly occupied substrate (78% of observations) with the majority (96%) of these being partly decayed (Webb 1985). As substrate use is often associated with prey capture it can be inferred that decaying coarse wood may provide important foraging opportunities at ground level; however, gut content analysis by Brown (1986) indicates that arboreal invertebrate prey obtained from aerial tree foraging also form a major proportion (52.3% within sample, n=82) of the diet of *P. spenceri*. Goldingay *et al.* (1996) noted a greater abundance of *P. spenceri* with an increase in log density following timber harvesting and an absence of *P. spenceri* in un-

Fig. 2. Spencer's Skink on the arm of a surveyor. Photo by Damien Navaud.

logged dry forest plots. This suggests that deadwood with environmental moisture conditions conducive to the establishment of wood decay and associated saprophagous invertebrate communities could be a critical resource for *P. spenceri*. In addition to the quantity of dead organic material (logs and litter) the level of insolation is an important influence on patterns of habitat usage in skinks within sclerophyll forests (Kutt 1999).

Climbing emergent trees to rise above understorey vegetation and thereby gain access to direct sunlight for thermoregulation, may be a driver of arboreal behaviour (Rawlinson 1975; Webb 1985; Kutt 1999). This hypothesis is supported by the findings of Brown and Nelson (1993), who noted the absence of *P. spenceri* at ground level in the successional stages of wet sclerophyll forest with the densest canopy cover (11–63 years old). At the scale of an individual overmature *E. regnans* the isobilateral leaf shape allows high levels of light penetration through the canopy (Keith *et al.* 2009), allowing insolation of the trunk. It has been suggested that sufficient light reaches the smooth bark to allow it to function as a photosynthetic organ (Sillett *et al.* 2010). The sightings reported here of *P. spenceri* basking on the smooth *E. regnans* bark supports the proposition that for an agile heliotherm such as *P. spenceri*, the level of insolation received on a live overmature *E. regnans* stem is likely to be sufficient for basking and suggests that thermoregulation is not restricted to dead trees.

Both elevation above the understorey and the presence of aerial deadwood are defining characteristics of overmature *E. regnans* (Ashton 1975; Mifsud 2003), and our observations suggest that these trees may provide an important combination of resources for *P. spenceri*. The availability of these resources (aerial deadwood and elevation for insolation) provided by living *E. regnans* are likely to remain longer than post-fire stags which are more disposed to structural collapse (Gibbons and Lindenmayer 2002), thus allowing *P. spenceri* populations to use old growth forest. This hypothesis is supported by the findings of Kutt (1999) who recorded a significantly greater abundance of *P. spenceri* in mature growth compared to 25–35 year old

Fig. 3. Spencer's Skink on the arm of a surveyor. Photo by Damien Navaud.

regrowth stands. Documenting the use of living overmature trees by *P. spenceri* is important to the management of this species in relation to forestry practices as retention of individual overmature *E. regnans* may have significant influence on their distribution. Whilst not listed as a threatened species, these findings also provide further evidence of the importance of oldgrowth forest for maintaining forest fauna.

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Fauna monitoring in eastern metropolitan parks

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Abstract
The Fauna Survey Group of the Field Naturalists Club of Victoria currently is undertaking a wide ranging fauna survey in three parkland complexes east of Melbourne, in conjunction with Parks Victoria and interested volunteers. The main survey techniques are remote cameras, hair tubes, spotlights, harp traps, artificial habitat (tiles and tin) and sound recorders. Parks Victoria, Melbourne Water and the Knox Environment Society have provided financial support. Boral Industries have provided roof tiles. Fauna monitoring is a necessary part of environmental management and is often not well funded. This project provides an opportunity to gain an understanding of the best methods for monitoring important species; how members of the community can best be involved; and how the program might best be supported in the longer term. (*The Victorian Naturalist* **131** (1) 2014, 28-30)

Keywords: fauna monitoring, community engagement, urban parks

Introduction

The Field Naturalists Club of Victoria (FNCV) is a long-established volunteer group interested in understanding the natural world. The club has nine special interest groups, with seven covering the specific areas of botany, fauna survey, fungi, geology, marine research, microscopy and terrestrial invertebrates, and another two, the Day Group and the Juniors, which are more generic in activity.

The Fauna Survey Group holds a research permit under the *Wildlife Act 1975* and *National Parks Act 1975*. This permit allows the group to apply a range of survey techniques to determine the presence of vertebrate fauna. Since 1972, over 700 surveys, many in areas managed by Parks Victoria, have been conducted by the group.

After carrying out a remote camera survey in Baluk Willam, Belgrave South, in August 2012, the group was approached by Parks Victoria to participate in a project comprising a much larger survey involving a number of parks to the east and south-east of Melbourne.

The aims of the project are:
- To develop a vertebrate fauna list
- To involve the community
- To assess the success of survey techniques used
- To assess the success of the project, with a view to involving the community in ongoing monitoring projects.

The survey covers 45 focus areas (areas of land selected for research) and is within three parkland complexes: Berwick, Dandenong Valley and Sandbelt.

The study surveys for mammals, including bats, as well as birds, reptiles and frogs. The main survey techniques involve the use of remote cameras, harp trapping, hair tubing, spotlighting, visual and audio bird surveys, audio frog surveys and the establishment and monitoring of artificial habitat (roof tiles and tin) for reptiles, amphibians and small mammals. Supplementary techniques such as AnaBat™ and Songmeter™ will be considered. Fox scats will be collected and analysed to identify prey items, nest-boxes will be checked where available, and kangaroo counts will take place at Churchill National Park. Not all focus areas will be subject to all techniques.

Planning for the project commenced in September 2012, with grant applications to government and local donors. Funding has been received from Knox Environment Society, Parks Victoria and Melbourne Water. In addition, Boral Industries have supplied roof tiles for the reptile surveys.

The first survey work took place in March 2013.

Survey area

The three parklands contain a total of 17 parks and nature conservation reserves.

The Dandenong Valley Parkland, which follows the Dandenong Creek, includes the area from Jells Park in the south to Koomba in the north and also includes Wattle Park.

The Berwick Parkland includes Churchill and Lysterfield Parks and the Police Paddocks and

parks on the Cardinia Creek and at the Cardinia Reservoir. It also includes Baluk Willam, Selby and Critchley Parker Junior Reserves.

The Sandbelt Parkland includes Braeside and Karkarook Parks.

The total area exceeds 4500 ha.

The parks have had a varied history and ownership. Previous uses include water storage, drainage, farming and agriculture, quarrying, timber harvesting, power line easement and waste water treatment (Parks Victoria 2002, 2006, 2009; MMBW 2007).

Because of this, the vegetation has undergone significant change since pre-European times. Nevertheless, there are pockets of Ecological Vegetation Classes (EVCs) considered to be threatened both within the Gippsland Plains bioregion and statewide, including Heathy Woodland, Swampy Riparian Woodland, Swamp Scrub and Riparian Forest. Despite, or perhaps because of, the changes, the parks still play host to a variety of fauna. The management plans (Parks Victoria 2002, 2006, 2009; MMBW 2007) identify a range of fauna. Common species such as Eastern Grey Kangaroo *Macropus giganteus*, Black Wallaby *Wallabia bicolor*, Common Brushtail Possum *Trichosurus vulpecula*, Common Ringtail Possum *Pseudocheirus peregrinus* and Common Wombat *Vombatus ursinus* are regularly seen. The Powerful Owl *Ninox strenua*, the Australian Grayling *Prototroctes maraena* and Dwarf Galaxias *Galaxias pusilla*, all of national significance, can also be found here. The parks provide a home to birds, such as Lewin's Rail *Railus pectoralis*, listed under the *The Flora and Fauna Guarantee Act 1988* (FFG Act), and the Great Egret *Ardea alba*, listed under the JAMBA/CAMBA migratory bird agreements with Japan and China.

Land management has been, and continues to be, the responsibility of different parties. The principal players are Parks Victoria, Department of Environment and Primary Industry, Melbourne Water, local government and Committees of Management (Parks Victoria 2002, 2006, 2009; MMBW 2007), but the success of any plans relies heavily on the support of community groups, adjacent landholders or managers and other park users. Management plans have been developed as a framework to identify the issues and provide a set of common strategies and actions for all the stakeholders. Being urban parks, there is a challenge in meeting the multiple demands from recreational users as well as providing for any conservation values.

The plans have identified the need to establish a baseline of the biodiversity in each park to better develop appropriate conservation strategies and to monitor systematically any apparent biotic change as these improvement strategies are implemented.

Community Involvement

Bell *et al.* (2008) pointed out the need for amateur naturalists to be involved in the collection data for biodiversity monitoring, because of the increasing need and the lack of professional resources to cope with the demand.

This proposal has provided the opportunity to bring together volunteer and corporate resources through the involvement of Parks Victoria, FNCV, Melbourne Water (Frogwatch), Birdlife Melbourne and the local friends, landcare and other environmental groups, such as the Knox Environment Society.

Community engagement commenced with information sessions at each of the three parklands, thus providing an overview of the project for interested parties. The project has been divided into the areas involving cameras and hair tubes, spotlighting and bat trapping, frog surveying, bird watching and reptile surveying. Email lists have been developed to contact participants about activities to the extent of their interest.

Opportunities have been provided to participate as follows:

- The deployment of cameras and hair tubes.
- Analysis of camera images, which have been uploaded onto Dropbox™ for ease of distribution and access.
- Participation in spotlighting and bat trapping.
- Participation in aural surveys for frogs, supported by a Melbourne Water training session. The results have also been placed on Dropbox™ for information and training purposes.
- Participation in training sessions for tile and tin deployment for reptile surveys.

Further participation opportunities exist with the deployment of tiles and tin and the subsequent monitoring of these sites, as well as any bird surveys that take place.

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Australian Natural History Medallion 2013: Marilyn Hewish

The 2013 Australian Natural History Medallion has been awarded to Marilyn Hewish, who was nominated by the Geelong Field Naturalists Club.

Marilyn Hewish joined the Geelong Field Naturalists Club (GFNC) in 1982, and for more than 30 years has demonstrated an ongoing commitment to expanding knowledge of Australian natural history. Her interests are wide ranging but her field activities have focused mostly on Australian birds. In the past five years, she has developed expertise in the study of Victorian moths.

Marilyn has organised and participated in a number of surveys and bird counts. From 1985 to 1990, she coordinated the National Wader Counts, and in 1988 she coordinated the Victorian Summer Waterfowl Count at 472 wetlands. She has taken part in many other surveys including Orange-bellied Parrot Counts (since 1982), Hooded Plover Counts (since 1984), RAOU Wetland Surveys (1987–1992) and Wader Counts (since 1985), as well as wildlife Atlas projects for the RAOU (now Birdlife Australia) and the Department of Sustainability and Environment.

Marilyn was a sub-editor for the Habitat and Movements sections for three volumes of the *Handbook of Australian, New Zealand and Antarctic Birds*. She has compiled numerous reports for the RAOU, the Department of Natural Resources and Environment and Parks Victoria. She has also been involved as an author and editor in the publication of a number of books, including *Birds of the Long Forest*, of which she was the senior author. Long Forest is an isolated mallee remnant 50 km from Melbourne and has birds typical of drier areas in north-west Victoria. The book combined her own survey data from 430 field visits, records from over 60 individuals and organisations, and data from literature sources back to the 1880s. It presents a complete current and historical record of the birds in this unique area of Victoria.

For 18 years (1991–2008), Marilyn was editor of the annual *Geelong Bird Report* (GBR), a series that is subscribed to by organisations across Australia and overseas. In the early years, bird observations were submitted through the GFNC Bird Group and published as part of the *Geelong Naturalist*. From 1993, the GBR was published as an independent magazine. Papers on birds were also published, often authored by Marilyn or by inexperienced authors who were guided by her. The GBR is an outstanding publication.

Marilyn has an enviable record in publishing her field studies. Since 1983 she has had about 60 articles published in the *Geelong Naturalist*, the majority of which have been on birds and bird behaviour. In addition, between April 2007 and December 2009 Marilyn wrote a monthly column in the *Geelong Naturalist* which covered topics as diverse as clouds, Killer Whales, solar eclipses, cicadas, moss, trees of the Geelong region, the moon, orchids and what naturalists should have in their backpacks.

Marilyn has given numerous talks and led birdwatching excursions for a wide range of ornithological, environmental and community groups. She has presented papers to many key groups in Victoria, interstate and overseas. In Victoria, she has made presentations in Geelong on many

occasions and has also spoken at meetings of Field Naturalist Clubs, Bird Observers Clubs and other groups in Ballarat, Colac, Bendigo, Warrnambool and Castlemaine. The topics covered are wide ranging and include survey results, bird-watching expeditions and trips, historical figures in Victorian birding and in-depth presentations on species or groups of birds. In particular, she has shared her special knowledge of the Long Forest with many people.

As a result of these wide-ranging activities, Marilyn's influence on a generation of Victorian bird enthusiasts has been substantial, and she has inspired and mentored both beginners and experienced naturalists.

In the last five years, Marilyn has changed her focus from birds to moths (Lepidoptera). In a short space of time, she has become a valued volunteer in the Museum Victoria Entomology Department. With Peter Marriott, she is sorting, identifying and cataloguing the Museum's moth collection and has led Lepidoptera teams on major surveys conducted by the Museum with Parks Victoria and the ABRS. She has joined the team of authors and editors producing the book series, *Moths of Victoria*, initiated by Peter Marriott. These books will eventually form a field guide covering all moth species in the state. She has collected specimens throughout Victoria for the Museum; amassed a photographic library of living moths of more than 1000 species; published papers and reports; and given talks and held night-time demonstrations of moth survey techniques for naturalist clubs and the general public, in which family groups are welcome. Her dedicated fieldwork has led to the discovery of several species new to science, first records for Victoria and major range extensions.

Marilyn is a Life Member of the GFNC, in recognition of her enduring efforts over more than 30 years to educate, inform and inspire others to an appreciation of natural history.

The Medallion was presented to Marilyn by the President of the Royal Society of Victoria, Dr Bill Birch AM, on 11 November 2013.

Gary Presland
Secretary
ANHM Committee

Australian Natural History Medallion Trust Fund

Since November 2012 donations to the Trust Fund have been gratefully received from the following:

Helen Aston	$100	David Cheal	$10
Julia Davis	$10	Valda Dedman	$5
William Fenner	$10	Helen Handreck	$10
Colin Hutchinson	$5	Neil McFarlane	$25
Juris Ozols	$20	Carol Page	$100
Geoff Patterson	5	Alan Reid	$15
Jonathon Stevenson	$25	Phyllis Western	$10
Field Naturalists Club of Northern Territory			$50
La Trobe Valley Field Naturalists Club			$100
Royal Society of Victoria			$250

If you would like to contribute to this fund, which supports the Australian Natural History Medallion, donations should be sent to: The Treasurer, Field Naturalists Club of Victoria, P O Box 13, Blackburn, Victoria 3130. Cheques should be made payable to the 'Australian Natural History Medallion Trust Fund'.

The medallion is awarded annually to a person who is considered to have made the most significant contribution to the understanding of Australian natural history in the last ten years.

Gary Presland
Secretary, ANHM Committee


AUSTRALIAN